CODE DIVISION MULTIPLEXING COMMUNICATION SYSTEM AND METHOD

BACKGROUND OF THE PRESENT INVENTION

1. Field of the Invention

The present invention relates to a spectrum spread communication system.

2. Description of the Related Art

FIG. **12** is a block diagram showing an example of a conventional spectrum spread communication system.

The spectrum spread communication system shown in FIG. **12** using a radio LAN constructed to the mode specified by IEEE 802.11.

This prior art shown in FIG. **12** comprises a transmitter **210** for transmitting a predetermined signal and a receiver **220** for receiving the signal transmitted from the transmitter **210**. The transmitter **210** is provided with a terminal **215** for receiving an input of serial data, an S/P converter **211** for converting the serial data input from the terminal **215** into parallel data, a code generator **213** for generating a Barker code as a spread code multiplied by the data signal which has been converted by the S/P converter **211**, a spread device **212** for multiplying the Barker code by the data signal converted by the S/P converter **211**, an analog transmission process device **214** for modulating the data signal multiplied by the Barker code in the spread device **212** and a terminal **216** for transmitting the data signal modulated by the analog transmission process device **214** to the receiver **220**. The receiver **220** is provided with a terminal **221** for receiving a data signal transmitted from the transmitter **210**, an analog reception process device **225** for amplifying the data signal received by the terminal **221** and converting the data signal into a base band signal, a correlator **226** for taking a correlation between the Barker code multiplied by the data signal converted into the base band signal in the analog reception process device **225** and the Barker code at a timing of the code generator **213** and outputting a data signal based on a resultant correlation, a demodulator **227** for demodulating the data signal output from the correlator **226**, a P/S converter **228** for converting the data signal (parallel data) demodulated by the demodulator **227** into serial data and a terminal **229** for outputting the serial data which have been converted through the P/S converter **228**.

FIG. **13** is a block diagram showing a construction example of the correlator **226** as shown in FIG. **12**.

The prior art correlator shown in FIG. **13** comprises a plurality of delay devices **401** each at a delayed chip rate, multipliers **402** for +/−1 multiplication and adders **403** for addition. Multiplier factors +1 and −1 of the multipliers **402** are identical to the Barker code sequence.

A communication operation of the above-constructed spectrum spread communication system is hereinafter described. It is assumed that a signal transmission rate is at 2 Mbps and an 11-bit Barker code as a spread code is used for the spectrum spread.

When the serial data are input to the terminal **215**, the input serial data are converted into parallel data by the S/P converter **211**.

A Barker code as a spread code is generated by the code generator **213** which is multiplied by the data signal converted by the S/P converter **211** and then output at a chip rate of 11 MHz.

Then in the spread device **212**, the Barker code is multiplied by the data signal which has been converted by the S/P converter **211**.

In the analog transmission process device **214**, the data signal which has been multiplied by the Barker code in the spread device **212** is modulated for transmission to the receiver **220**.

The data signal modulated by the analog transmission process device **214** is transmitted to the receiver **220** via the terminal **216**.

The data signal transmitted from the transmitter **210** is received by the receiver **220** via the terminal **221**.

The data signal received via the terminal **221** is amplified and converted into a base band signal in the analog reception process device **225**.

Then in the correlator **226**, a correlation is between the Barker code multiplied by the data signal which has been converted into the base band signal by the analog reception process device **225**, and the Barker code at a timing of the code generator **213**. Based on the obtained correlation result, the data signal is output.

Output of the correlation result provided by the correlator **226** is hereinafter described.

FIG. **14** shows an output of the autocorrelation value of the 11-bit Barker code.

FIG. **15** shows an output signal of the correlator **226** when delay distortion exists.

When the timing is at 0, the autocorrelation becomes +1. When the timing is not 0, the autocorrelation becomes −1/11 value or zero. A delay wave is generated on the transmission path owing to multipath distortion. As FIG. **15** shows, the delay wave is divided by each chip at every spectrum spread through the spread device **212**. The chip signal having the highest correlation value is only extracted in the correlator **226** and the chip signal having low correlation values (i.e., chip signal resulted from the delay wave) is removed. As a result, the distortion resulted from the delay wave is reduced.

After the correlator **226** outputs the data signal based on the correlation result, the demodulator **227** demodulates the data signal. Then the demodulated data signal is converted into serial data by the P/S converter **228**.

Finally the converted serial data are output from the terminal **229**.

In order to increase the transmission rate in the conventional spectrum spread communication system, the symbol rate is required to be increased or the number of bits added per symbol is required to be increased. These processes for increasing the transmission rate have the following problems.

(1) Increasing the symbol rate:

The spread ratio is specified to be set to 10 times or more in an ISM band at 2.4 GHz in Japan. Additionally the band width is limited to 26 MHz. So the symbol rate cannot be doubled or it will exceed the conventional rate.

(2) Increasing added number of bits per symbol:

The added number of bits per symbol can be increased through a demodulation process such as multiphase PSK and QAM instead of QPSK. Accompanied with the increase in the number of bits, a bit error rate is increased under the influence of the delay distortion. The operation process is, thus, required to have higher accuracy for reducing such error. However it is practically and technologically difficult to realize the high accuracy of the operation.

For example, multiplexing the signal to 16-value or more QAM is required to obtain the transmission rate 2 times higher than QPSK. The 16-value QAM requires peak power 10 times more than that required by the QPSK. Also the bit